



Serial No. 09/358,940

### REMARKS

The Office Action mailed February 12, 2001, has been received and reviewed. Claims 1 through 4 and 6 through 15 are currently pending in the application. Claims 1 through 4, and 6 through 15 stand rejected. Applicants respectfully request reconsideration of the application in light of the remarks herein.

#### **35 U.S.C. § 103(a) Obviousness Rejections**

##### Obviousness Rejection Based on U.S. Patent No. 5,300,463 to Cathey

Claims 1 through 4 and 6 through 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Cathey (U.S. Patent No. 5,300,463). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

The Cathey reference discloses a method of utilizing and etching SiO<sub>2</sub> in the processing of semiconductor wafers. The method includes utilizing an acid solution comprising at least two different mineral (inorganic) acids in a selected ratio to one another, one of the inorganic acids being HF. The Cathey reference discloses that the solution comprising at least one inorganic (mineral) acid and HF selectively etches a doped SiO<sub>2</sub> layer. The Cathey reference further discloses that acetic acid may be included in the solution and provides an example wherein acetic acid is provided in a 2:1 ratio with HF. However, the Cathey reference also states, "[a]cetic acid is a known prior art component in wet acid etching which provides bath stabilization and extends bath life. Such does not constitute a part of this invention, nor is it necessary in the invention." (Cathey, col. 2, lines 49-53.)

By way of contrast with the Cathey reference, independent claim 1, recites, an etchant solution comprising “an organic acid and a fluoride-containing solution provided in a selected volumetric ratio relative to one another, wherein the selected volumetric ratio of the organic acid to the fluoride-containing solution is about 10:1 to about 500:1.”

Applicants respectfully submit that no motivation exists to modify the Cathey reference to incorporate an **increased** amount of *organic* acid into the solution. The Examiner states that it would have been obvious to modify Cathey’s solution by utilizing a volumetric ratio in the range of 10:1 to 500:1 range, because “the variation of process parameters is obvious and expected from one skilled in the art”, and because, “as Cathey discloses a higher HF content in the solution would result in a higher etch rate, and high etch rates are highly desirable during semiconductor manufacturing.” (Office Action, page 2).

Applicants respectfully submit that Examiner’s argument describes a solution *exactly opposite* the present invention. Cathey’s solution discloses a ratio of acetic acid to HF of 2:1. By way of contrast, independent claim 1 recites a volumetric ratio of organic acid to fluoride containing acid between about 10:1 to 500:1. Thus, applicants are *not increasing the content of HF* in the solution as compared to the Cathey reference. Instead, the present invention increases the amount of *organic acid* in the solution relative to the fluoride containing solution; **the concentration of HF (fluoride containing solution) does not increase**. Therefore, Examiner’s statement that it would have been obvious to increase the amount of HF in the solution is immaterial to examination of the present invention. Reconsideration is respectfully requested.

Examiner has misstated applicants’ arguments in the Response to Arguments. (Office Action, pages 3-4). Applicants submit there is no motivation in the Cathey reference to **increase** the amount of acetic acid (organic acid) in the solution. The Cathey reference explicitly states acetic acid is not a part of the invention and as such, one of ordinary skill in the art would not be motivated to **increase** the amount of acetic acid in the etchant solution. (Cathey, col. 2, lines 49-53). Further, the examiner expressly states that Cathey suggests increasing the amount of HF relative to the acetic acid (which is the **opposite** of the present invention)(Office Action, page 4). In this respect, the Cathey reference

clearly teaches away from *increasing the amount of acetic acid* (organic acid) in the etchant solution.

A prior art reference “must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention.” MPEP §2141.02. Further, applicants respectfully submit that Examiner is improperly applying an “obvious to try” rationale in this case. (Office Action, page 2; “variation of the process parameters is obvious and expected”). The “obvious to try” standard is inappropriate under §103:

In some cases, what would have been ‘obvious to try’ would have been to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful. . . . In other words, what was ‘obvious to try’ was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.

MPEP § 2145 (citations omitted).

In this case, applicants respectfully submit that it would not have been obvious to modify (increase) the amount of acetic acid in the Cathey reference as the reference teaches that acetic acid is merely a bath stabilizer and not a critical component of the etchant solution. Further, the Cathey reference lacks any suggestion that increasing the amount of acetic acid will affect the etch rate and selectivity ratio of the solution as described in Table 1 of the current application. (*Cf.* Table 1 of the present invention with Cathey, col. 2, lines 54-60). As such, applicants respectfully submit the Cathey reference does not render independent claim 1 of the present invention obvious.

Similarly, applicants assert that there can be no showing of a reasonable expectation of success to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 based upon the cited reference. The Cathey reference teaches “[a]cetic acid is a known prior art component in wet acid etching which provides bath stabilization and extends bath life. Such does not constitute a part of this invention, nor is it necessary in the invention.” (Cathey, col. 2, lines 49-53.) As such, no evidence exists, in either the Cathey reference or the art, that the modification of the Cathey reference would

be successful. Therefore, any rejection of the present invention based upon the cited prior art cannot establish a *prima facie* case of obviousness under 35 U.S.C. § 103. As such, independent claim 1, and all dependent claims therefrom, are allowable.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1970). All words in a claim must be considered in judging the patentability of that claim against the prior art. *In re Wilson*, 424 F.2d 1382, 165 USPQ 494, 496 (CCPA 1970). Applicants respectfully submit that the Cathey reference does not teach every limitation of the present invention.

Examiner acknowledges the Cathey reference does not teach a solution wherein an organic acid is in a volumetric ratio with a fluoride-containing solution at about 10:1 to about 500:1. (Office Action, page 2). Instead, the Cathey reference discloses that acetic acid (an organic acid) is not a necessary component of the invention. Further, the Cathey reference only discloses organic acid in a volumetric ratio of 2:1 with HF. (Cathey, col. 2, lines 49-53). As Cathey does not teach or suggest every element of claim 1 as proposed to be amended, Cathey does not anticipate the presently claimed invention. As such, claim 1, is allowable.

Claims 2 through 4 and 6 through 8 are each allowable as depending, either directly or indirectly, from claim 1.

Claim 6 is further allowable as the Cathey reference does not teach an etchant comprising acetic acid in a volumetric ratio with hydrofluoric acid at about 10:1 to about 100:1.

Claim 8 is further allowable because the Cathey reference does not teach or suggest an etchant solution exhibiting a selectivity ratio of borophosphosilicate glass to tetraethyl orthosilicate between about 27:1 and 55:1. The examiner acknowledges the Cathey reference does not disclose a BPSG to TEOS selectivity ratio in the range of 27:1 to 55:1. (Office Action, page 3). Applicants respectfully disagree with Examiner's conclusion that "the Cathey solution must also provide the same BPSG to TEOS selectivity ratio, as Cathey's etchant solution is similar to Applicant's claimed solution." (Office Action, page 4). The Cathey reference discloses an etchant solution comprising 840 ml H<sub>2</sub>SO<sub>4</sub>, 960 ml H<sub>2</sub>O, 30 ml HF and 60 ml acetic acid. (Cathey, col. 2, lines 43-45). *The*

*Cathey reference expressly states that this solution has a BPSG to TEOS selectivity ratio of only 6.3:1, not 27:1 to 55:1.* (Cathey, col. 2, lines 58-59). Further, the Cathey reference lacks any suggestion that increasing the amount of acetic acid will affect the etch rate and selectivity ratio of the solution as described in Table 1 of the current application. (Cf. Table 1 of the present invention with Cathey, col. 2, lines 54-60). Clearly, the solution of the Cathey reference does not possess a similar selectivity ratio as the etchant solution of the presently claimed invention.

Independent claim 9 of the present invention recites, an etchant solution comprising an organic acid and a fluoride-containing solution, "wherein the etchant solution exhibits a selectivity ratio of borophosphosilicate glass to tetraethyl orthosilicate between about 27:1 and 55:1." The examiner acknowledges the Cathey reference does not disclose a BPSG to TEOS selectivity ratio in the range of 27:1 to 55:1. (Office Action, page 3). Applicant respectfully disagrees with Examiner's conclusion that "the Cathey solution must also provide the same BPSG to TEOS selectivity ratio, as Cathey's etchant solution is similar to Applicant's claimed solution." (Office Action, page 4). The Cathey reference discloses an etchant solution comprising 840 ml H<sub>2</sub>SO<sub>4</sub>, 960 ml H<sub>2</sub>O, 30 ml HF and 60 ml acetic acid. (Cathey, col. 2, lines 43-45). *The Cathey reference expressly states that this solution has a BPSG to TEOS selectivity ratio of only 6.3:1, not 27:1 to 55:1.* (Cathey, col. 2, lines 58-59). Clearly, the solution of the Cathey reference does not possess a similar selectivity ratio as the etchant solution of the present invention. As Cathey does not teach every limitation of independent claim 9 of the presently claimed invention, applicants respectfully submit that independent claim 9 is not rendered obvious the Cathey reference. As such, independent claim 9 is allowable.

Claims 10 through 15 are each allowable as depending from independent claim 9.

Claim 13 is further allowable as the Cathey reference does not teach or suggest the acetic acid is in a volumetric ratio with the hydrofluoric acid at about 1:1 to about 500:1.

Claim 14 is further allowable as the Cathey reference does not teach or suggest the acetic acid is in a volumetric ratio with the hydrofluoric acid at about 10:1 to about 100:1.

Claim 15 is further allowable as the Cathey reference does not teach or suggest the organic acid comprises glacial acetic acid and the fluoride-containing solution comprises 40% ammonium fluoride by weight in water.

**CONCLUSION**

Claims 1 through 4 and 6 through 15 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, she is respectfully invited to contact Applicants' undersigned attorney.

Respectfully Submitted,



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Serial No. 09/358,940

**VERSION WITH MARKINGS TO SHOW CHANGE**

1. (Amended four times) An etchant solution which selectively etches borophosphosilicate glass over tetraethyl orthosilicate, said etchant solution comprising an organic acid and a fluoride-containing solution provided in a selected volumetric ratio relative to one another, wherein the selected volumetric ratio of the organic acid to the fluoride-containing solution is about 10:1 to about 500:1.